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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Kems, Kevin P. Case: NI 161- U&S
Art Unit: 1725
Applicant(s): Christoph Schilling, Alexander von Strombeck, Dr. Jorge dos Santos
Serial No.: 10/762050
Filing Date: 16/01/04
Title: METOD AND APPARATUS FOR JOINING AT LEAST TWO WORKPIECES BY FRICTION STIR WELDING

Commissioner for Patents
Alexandria, VA 22313-1450
FAX: 571 273 8300
Enclosed: Appeal Brief including 10 pages
Mailstop: DAC

November 6, 2007

Sir:

Following the Notice of Appeal dated 09/07/07 from the Examiner's final rejection dated 04/09/07 of claims 1 to 8 and 10 of the above-identified application, enclosed herewith is an appeal brief.

The amount required to cover the fee for filing the brief should be charged to deposit account No. **500465**.

Respectfully submitted,

K. Bach

Klaus J. Bach, Reg. No. 26832
Agent for Applicants

CERTIFICATE OF MAILING

I hereby certify that the correspondence is being transmitted to the United States Patent Office by FAX on: November 6, 2007- Fax 571 273 8300.

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SIR:

APPEAL BRIEF

This is an Appeal from the Examiner's Final Rejection dated 04/09/07 of claims 1 – 8 and 10 of the present application.

A NOTICE OF APPEAL was filed on Sept. 07, 2007.

i) REAL PARTY IN INTEREST

The real party in interest are the Applicants Christoph Schilling, Alexander von Strombeck, Dr. Jorge dos Santos, and the Assignee, the company GKSS Forschungszentrum Geestacht GmbH.

ii) RELATED APPEALS AND INTERFERENCES

There are no prior pending appeals, judicial proceedings or interferences known to Applicants which may be related to, directly affect or be affected by, or have a bearing on, the Boards decision in the pending Appeal.

iii) STATUS OF THE CLAIMS

Claims 1 – 8 and 10 are pending in this application. Claims 1 – 8 and 10 stand rejected under USC 102(a) as being anticipated by Nishihara (JPN 2002-256453A). The rejection of claims 1 – 8 and 10 is appealed.

iv) STATUS OF AMENDMENTS FILED AFTER FINAL REJECTION

No amendment has been submitted after final rejection.

v) SUMMARY OF THE CLAIMED SUBJECT MATTER

The references in parenthesis refer to the respective parts as shown in the drawings. There is only one independent claim, that is, claim 1.

As defined in the independent claim 1, the present invention resides in a method for joining at least two workpiece (13, 14) by friction stir welding using a rotating tool (10) with a pin-like projection (11).

The method comprises the following steps:

a) placing the workpieces (13, 14) on top of one another such that areas to be joined are disposed adjacent one another, and

b) moving the rotating tool (10) onto the uppermost workpiece (13) in the area where the workpieces are to be joined such that the pin-like projection (11) engages the uppermost workpiece (13) and, while being pressed against the workpiece, generates friction heat to at least plasticize the material of the upper workpiece (description page 6, lines 20 to page 7, line 1).

c) moving the rotating tool (10) axially toward the lowermost workpiece (14) through the material being plasticized only until it contacts to top surface of the lowermost workpiece (14) without penetrating the lower workpiece so as to produce, due to the friction of the pin-like projection (11) on the surface of

the lowermost workpiece (14), a metallically clean surface, whereby a gas-tight joint is formed between the upper and the lowermost workpieces (13, 14), (page 7, lines 1 – 3 and page 5, line 18 – 22 where it is said that the projection 11 of the tool 10 is advanced through the workpiece 13 into contact with the surface of the workpiece 14 and page 7, line 12 -15, where it is said that "by the friction of the projection 10 on the surface of the recess 15 on which the workpiece is disposed any oxides are removed from the surface of the recess 15 (that is, the surface of the workpiece 14) so that a gastight joint can be formed between the workpieces 13 and 14, see also page 3, lines 29 to page 4, line 2, page 4, lines 11- 16)

d) then removing the rotating tool (10).

vi) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The Board is to review the rejection of claim 1 – 8 and 10 as being anticipated by Nishihara, JPN 2002-256453A.

vii) ARGUMENTS

Arguments will be presented only with respect to claim 1. No independent protection is sought for the subject matter defined in the dependent claims. The dependent claims are considered to be directed to features that are advantageous in connection with the joining method as defined in claim 1, but the dependent claims 2 – 8 and 10 stand and fall with claim 1.

vii a) The prior art on which the rejection is based: Nishihara (JPN 2002-256453) apparently discloses a method for joining an upper workpiece (6) and a lower workpiece (5) wherein the material of the upper workpiece (6) is plasticized by a rotating friction welding tool (2). The plasticized material flows into cavities (5a) formed in the lower workpiece along the path of transverse movement C-D of the welding tool (2) for the engagement of the two workpieces.

It is not said exactly how far the tool (2) moves into, or through, the upper workpiece and it cannot be determined from this refcrence for example where the tip of the friction welding tool is stopped upon reaching the top surfacc of the lower workpiece.

vii b) The present invention: In accordance with the present invention, the rotating tool is moved axially through an upper workpiece (13) toward the lowermost workpiece (14) while the material of any upper workpiece is plasticized until the tip of the rotating tool contacts the top surface of the lowermost workpiece (14) so as to produce, due to friction of the pin-like projection (11), on the surfacc of the lowermost workpiece (14) a metallically clean surface so that a gas-tight joint is formed between the upper and lowermost workpiecs (13, 14) upon removal of the rotating tool (10).

This is not disclosed in the cited reference. In fact, the Examiner is asking how the members would bond with no plasticizing of the lower member when the conventional friction stir welding process requires plasticizing of both members, that is, also the lowermost member in order to form a strong joint. The answer is that, - contrary to the conventional friction stir process – with the method according to the invention no mixing of the materials of the upper and the lowermost workpieces takes placc nor is it desired. Rather, a so-called diffusion wcld joint is formed wherein individual atoms of one workpiece diffuse into the other workpiece so as to form a stable connection between the workpiecs. To this end, it is neither necessary nor is it desirable that also the lower workpiece is plasticized. It is however important that metallically clean surfaces are provided in order to enhance the diffusion of the individual atoms from onc workpiece into the other.

vii c) discussion of the Examiner's rejection:

The Examiner notes in his advisory action that friction stir welding is a relatively new process and is unlike all other welding processes. This is probably

a correct assertion as all aspects of the process have certainly not yet been thoroughly investigated.

It is for example assumed – as it is obviously done in the cited reference - that the materials of components being joined must be able to be at least plasticized to provide for intermixing of the materials at the interface between two components being joined. Not so, say the inventors of the present invention: The lowermost workpiece should or in fact must not be plasticized to provide for the jointure, as the jointure is established by a diffusion process wherein the lowermost workpiece is not plasticized at all.

Certainly such a friction stir welding procedure, wherein plasticization of the lowermost workpiece is avoided, is not disclosed in the cited reference nor is it in any way suggested therein that plasticizing of the lowermost workpiece should or must be avoided.

The procedure according to the invention is therefore certainly not anticipated by the cited reference nor is it any way obvious therefrom.

Claim 1 should therefore be patentable over the reference cited by the Examiner.

It is finally noted once more that the dependent on claim 2 – 8 and 10, are dependent on claim 1 and consequently include all the features of claim 1. They stand and fall with claim 1.

The Board is respectfully requested to reverse the Examiner's final rejection of claims 1 to 8 and 10 of the present application as being anticipated by the cited prior art reference and direct the Examiner to allow the claims.

Respectfully submitted,

K. Bach

Klaus J. Bach, Reg. No. 26832

APPENDICES

viii) CLAIM APPENDIX

1. A method for joining at least two work pieces (13, 14) by friction stir welding using a rotating tool (10) with a pin-like projection (11) comprising the steps of:

[a] placing said at least two work pieces (13, 14) on top of one another such that the areas to be joined are disposed adjacent one another,

[b] moving said rotating tool (10) onto the uppermost work piece (13) in the area where the work pieces are to be joined such that said pin-like projection (11) engages said uppermost work piece (13) and, while being pressed against said work piece, generates friction heat to at least plasticize the material of said uppermost work piece (13),

[c] moving said rotating tool (10) axially toward the lowermost work piece (14) through the material being plasticized only until it contacts the top surface of the lowermost work piece (14) without penetrating the lower workpiece so as to produce, due to friction of the pin-like projection (11) on the surface of the lowermost workpiece (14), a metallically clean surface whereby a gastight joint is formed between the upper and the lowermost workpiece (13, 14), and

[d] then removing said rotating tool (10).

2. A method according to claim 1, wherein an alloyed joint is formed between the work pieces by the plasticized materials which were intermixed during the friction stir welding.

3. A method according to claim 1, wherein oxides are removed from the surfaces of the work pieces as the pin-like projection (11) frictionally engages the surfaces of the work pieces.

4. A method according to claim 1, wherein the tool (10) with the pin-like projection (11) is moved along the joint area.

5. A method according to claim 1, wherein pressure is applied to the material while being plasticized.

6. A method according to claim 5, wherein the pressure is applied by a shoulder (12) of the tool (10) around the pin-like projection (11).

7. A method according to claim 1, wherein the work pieces (13, 14) are joined also in a form-locking manner.

8. A method according to claim 7, wherein said work pieces (13, 14) are joined in a form-locking manner by the introduction of plasticized material into cavities (16) formed into the lower work piece (14).

10. A method according to claim 1, wherein the length of said pin-like projection (11) is selected so as to correspond essentially to the thickness of the uppermost work piece (13) or upper work pieces placed on top of the lowermost work piece (14).

ix) EVIDENCE APPANDIX

none

x) RELATED PROCEEDINGS APPENDIX

none